the only good work as yet done in this direction being that of Wm. Smith—a man considerably like Murchison in character, though in a lower walk of life, and who had mapped and arranged most of what we now call secondary rocks. Much remained yet to be done both among these and above them, but below them was a perfect blank. No one had yet attempted to attack the monster "Grauwacke" in his fastnesses. It was not, however, to be conquered by a tyro, and it was only after minor attempts elsewhere that Murchison made the assault upon it from above, while Sedgwick undermined it from below.

Murchison's life hitherto has not been such as to lead us to expect much of him; but a study of his biography and a knowledge of his works prove that we must from this time see him in a different light; without indeed the advantages of early training, yet earnestly doing his best under the circumstances to advance the cause of science in that way in which alone he could hope to do so. He was one of those who

> "rise
> On stepping-stones of their dead selves
> To higher things;"

and we next hear of him as a diligent student of Brande, Buckland, Webster, and Wollaston, and very shortly following out, at the suggestion of others, some new lines of inquiry, where information was wanted. The discussion of these works we will postpone for the present, and pass on to the sketch of his life henceforth as detailed for us so clearly by Prof. Geikie.

His first excursion was in the summer of 1825, when he was accompanied by his wife, and made a tour of nine weeks on the south coast, from the Isle of Wight into Devon and Cornwall. "Driving, boating, walking, or scrambling, the enthusiastic pair signalised their first geological tour by a formidable amount of bodily toil."

Murchison associated himself early in his geological career with Sedgwick, with whom he had many a happy and profitable tour, the first of which took place in 1827, when they went together to the Island of Arran. Murchison's summers for many years now were spent in the field, while his winters in London were given to society, and to the work of the Secretary of the Geological Society, which he voluntarily undertook. It was not till 1831 that he first broke ground in "Siluria," the results of which appeared after many delays, in 1838, in the well-known "Silurian System." He was not content with work in England only, but quite as often traversed the Continent, bringing home results, and enjoying the society of the chiefs of geology abroad. No sooner was his first work well off his hands than he began to contemplate an excursion to Russia to trace the same rocks there, and having been partially successful in 1840, the next year he surveyed the whole of the Ural Mountains under the auspices of the Emperor, and with the assistance of Count Keyserling and De Verneuil, the results of which survey appeared in 1845 in the magnificent work entitled "Geology of Russia and the Ural Mountains."

From this time Murchison's position in the ranks of geologists was secure. How did he use it? To this there can be but one answer. He used all the influence his position gave him for the advancement of science. His personal energies never flagged; no summer passed but he did good work, which now forms part of the common property of geologists. Each autumn saw him enthusiastically engaged in the work of the British Association, of which he was president in 1846, and in which he ever continued to take a genuine interest. During these years his devotion to the Geographical Society increased, and, as our readers know, he was in the end regarded as so indispensable to its prosperity, that for the last ten years of his life he was president.

This Society was almost of his own making, for it was a very different thing when he joined it to what it was when he died; and perhaps some little feeling of jealousy may be entertained by geologists at the apparent transference of his affections. But it should be remembered that throughout his career Murchison was a pioneer. His works are all masterly outlines of fresh fields; and when by the time that infirmities in any case would prevent him from doing much field-work, he found a large band of geologists working at details throughout Europe. No room was left for such preliminary investigations as his, unless he went by proxy, so to speak, to countries far away; and in the end he was strictly serving Geology, by encouraging Physical Geography; for the former is impossible without the foundation of the latter being laid.

As Director-General of the Geological Survey, a post which he held from the death of Sir H. De la Beche in 1855 until his own decease in 1871, he earned the gratitude of geologists by the enlarged scope he persuaded the Government to give to it, and its consequent rapid and invaluable work; while in this and in other ways he was always ready and anxious to help forward any rising worker in the field.

Into further details of his life—how honours were poured on him from all sides, which he received with avidity; how he never failed to enjoy the delights of society; how he obtained a Geographical Section at the British Association; how he endowed a professorship of Geology—into these we cannot enter more fully, but must refer the reader to the book itself, where they are all admirably set forth.

The last words of Prof. Geikie on the character of Sir Roderick Murchison are very good. He traces the success of his career and the value of his life to three main sources. "Foremost we would place his vigorous energy, his unwearied and almost reckless activity. He never seemed to be without a definite and well-planned task." "Another leading feature in his character . . . was shrewd common sense and knowledge of the world;" and "there was still another characteristic which secured to Murchison the esteem as well as the respect of his fellow-men—his thorough kindliness and goodness of heart." Every one of these features is amply illustrated in the details of his life; and though other features, perhaps not quite so imitable, may strike us on its perusal, yet these stand out in the foreground, and teach the ever-required lesson that industry and energy are the invariable forerunners of success. (*To be continued.*)

THE FLORA OF BRITISH INDIA

The Flora of British India. By Dr. J. D. Hooker, C.B., assisted by various Botanists. Vol. I. Ranunculaceæ to Sapindaceæ. (London: Reeve and Co.)

THE completion of the first volume of the Flora of India is an event of no small importance in descriptive botany. That India should be almost the last of our possessions whose vegetable wealth botanists have undertaken to describe in a systematic order, is due to various causes, not the least of which is the enormous labour of collecting and sifting the scattered literature bearing on this subject. The books and short papers on the botany of various parts of India are exceedingly numerous, and several works have been commenced never to be completed. Dr. Hooker himself, in conjunction with Dr. T. Thomson, published some years ago the first volume of a Flora of India based upon a more elaborate plan than that of the work now in progress, which departs from that of the other Colonial Floras, Hooker's "Student's Flora of the British Islands" having served as a model.

In addition to British India proper, this work embraces the territories of the Malayan Peninsula, Kashmir, and Western Thibet; but Afghanistan and Baluchistan, having been taken up by Boissier in his "Flora Orientalis," are not included. The total area under investigation exceeds a million square miles, exhibiting every variety of climate, soil, and other conditions, and ranging from the sea-level to an altitude of 19,000 feet, which is about the upper limit of flowering plants. Dr. Hooker computes the total number of species growing within this area at 12 to 14,000, which is doubtless not very wide of the mark, judging from the number reached up to the end of the *Sapindaceæ.*

In the first place we will give a glance at the contents of the present volume, which forms about a sixth part of the whole work. Exclusive of an index of forty pages, it extends to about 700 pages, and includes descriptions of 2,250 species under 442 genera, belonging to forty-four natural orders. These figures do not take in introduced plants incidentally mentioned or fully described. Contrasting these numbers with those afforded by the flora of tropical Africa up to the end of the *Sapindaceæ*, we obtain some idea of the relative richness of the vegetation of tropical Asia, especially if we bear in mind that the area of tropical Africa is more than six times the extent of India. True, African vegetation is not so well known, but future discoveries in the respective countries will probably not materially alter the proportions. The numbers for tropical Africa, which we have added up in Oliver's "Flora of Tropical Africa," are 945 species in 250 genera, and forty-five natural orders. It will be seen that the number of natural orders is almost the same, one more being represented in Africa than in India. A very large proportion of the species enumerated in the volume before us are exclusively Asiatic; we have not made an exact calculation, but should estimate it at ninety per cent. Of the 442 genera, 164 are, so far as our present knowledge goes, peculiar to Asia. The greater part of the peculiar genera are tropical, and many of these, doubtless, still remain to be discovered in New Guinea and tropical Australia. The mountains of Northern India have furnished our parks and gardens with many useful and ornamental trees, &c.; e.g., *Cedrus Deodara* and *Pinus excelsa;* and many others might be introduced with a view to profit or pleasure. In most cases, where possible, Dr. Hooker gives the altitudes at which the species are known to occur; but of course this part must still be imperfect. We have made a list of those species reported as growing *above* 10,000 feet, and it includes nearly 250 species, or about a tenth part of the whole number. These belong chiefly to the *Ranunculaceæ*, *Cruciferæ*, and *Caryophylleæ*, and contain a large number of endemic species; the remainder being chiefly common either to Siberia or the Alps of Southern and plains of Northern Europe, including many common British plants. We will not trouble the reader with many more figures, but we may select a few more to give a general idea of the vegetation up to the point reached in this volume. Taking two or three examples of those orders consisting mainly of herbaceous plants or climbing shrubs, we have *Ranunculaceæ*, 115 species, or 5·2 per cent; *Cruciferæ*, 137 species, or about 6 per cent.; *Caryophylleæ*, 104 species, or 4·6 per cent.; and *Geraniaceæ*, 165 species, or 7·3 per cent. Turning to the woody orders which characterise the tropical and sub-tropical regions, we have *Anonaceæ*, 190 species, or about 8·5 per cent.; *Dipterocarpeæ* (an almost exclusively Asiatic family), 92 species, or about 4 per cent.; *Guttiferæ* 61, *Tiliaceæ* 109, *Meliaceæ* 83, *Olacineæ* 66, *Celastrineæ* 105, and *Sapindaceæ* 70 species. Among genera numerous in species we may mention *Capparis Garcinia*, *Grewia*, *Impatiens*, and *Vitis.* Considerably more than a hundred species of *Impatiens* are described, and about 75 of *Vitis*; seven of the former genus ascend above 10,000 feet, and nearly all of them are very restricted in their geographical area. In tropical Africa there is about the same number of species of *Vitis*, but only one or two are common to both regions, the others being endemic.

So far we have confined ourselves to an attempt to indicate the interest of the work as a contribution to phytogeography; its usefulness in applied botany cannot be over-estimated. It would not be difficult, it is true, to point out a great many little defects and inequalities in elaborating the materials at their disposal by the different contributors. But those whose experience is least in this branch of botany are aware of the difficulties encountered at every step. In the first place, the limitation of species must be more or less arbitrary, and it is by no means an easy task to settle the limits, in this case especially, on account of the large number of forms described as species by botanists of all nations in innumerable books and journals. The view here taken of species is a broad one; hence we find that there is an average of two synonyms to each species, and in some instances the array of names is something quite formidable. Of course many of these synonyms result from individual views respecting generic limits. As to genera, there is little deviation from Hooker and Bentham's "Genera Plantarum," though an examination of a large number of specimens has frequently necessitated a modification of the diagnoses of certain genera. As to "polymorphous species," the forms readily distinguished are briefly characterised as varieties; but it is assumed that the extreme forms collected under one species are united by every intermediate gradation, so that it is not possible in practice to say to which variety some forms should be referred. We have already mentioned that Hooker's "Students' Flora" has been followed mainly in the style of arranging the matter, and this no doubt is an improvement in some respects on the Colonial Floras; but the absence of keys to the species of each genus, in our opinion, is not compensated for by the change. In the "Students' Flora" the synonyms are given in italics, and readily catch the eye; but in the "Flora of India" they are printed in the same type as the descriptions, and are difficult to find, especially as one is so unaccustomed to this method. Under each genus and species the geographical area is given, and in most cases pretty fully; but most of the numerous discoveries in tropical Australia since the publication of the "Genera Plantarum" have been overlooked: we allude to those already published in the "Flora Australiensis." Other little slips of this sort occur. For instance, there is a species of *Berberis* in Abyssinia.

Dr. Hooker has contributed largely to this volume, and the following botanists have assisted:—Dr. M. T. Masters, *Malvaceæ*, &c.; Mr. W. P. Hiern, *Sapindaceæ*, &c.; Prof. W. T. T. Dyer, *Dipterocarpeæ*, &c.; Prof. Lawson, *Ampelideæ*, &c.; Mr. A. W. Bennett, *Polygaleæ;* Dr. Anderson, *Guttiferæ;* and Dr. T. Thomson and Mr. M. P. Edgeworth were also associated with Dr. Hooker in the elaboration of certain orders. A comparison of the work of the different contributors brings out the defects of some rather strongly, but it would obviously be unfair to single them out, because they have not done quite so well as the best.

This is a good solid instalment towards a portable flora of India; and with so numerous a staff of botanists, well qualified for the task, we may confidently hope that the work will proceed with tolerable rapidity. True, the first part of this volume appeared in 1872, but we anticipate a better rate of progress for future volumes.

OUR BOOK SHELF

Proceedings of the London Mathematical Society. Vol. V. 150 pp. (London: Hodgson, Gough Square, 1875.)

FORMER volumes of these Proceedings have embraced the Transactions of two and even of three sessions; this contains the Transactions of one session only; hence the smallness of the volume. The longest paper in it is a valuable geometrical memoir, by Dr. Hirst, "On the correlation of two planes." When the points and right lines of two planes are so associated that to each point in one of the planes and to each line passing through that point, respectively correspond, in the other plane, *one* line and *one* point in that line, then a correlation is said to be established between the two planes. The author indicates in a note how his results are also all applicable to the case of two homographic planes.

Prof. Cayley contributes papers on Steiner's Surface and on certain constructions for bicircular quartics. Lord Rayleigh has a note "On the numerical calculation of the roots of fluctuating functions." Mr. J. W. L. Glaisher writes "On the transformation of continued products into continued fractions." Mr. C. J. Monro has a note "On the inversion of Bernoulli's theorem in probabilities." Mr. Samuel Roberts also contributes a note "On the expression of the length of the arc of a Cartesian by elliptic functions," and "The parallel surfaces of developables and curves of double curvature;" Mr. Spottiswoode has a paper "On the contact of quartics with other surfaces;" and Mr. H. M. Taylor "On inversion with special reference to the inversion of an anchor-ring or torus." Interesting papers of a more elementary character are contributed by Mr. J. Griffiths "On the Cartesian equation of the circle which cuts three given circles at given angles," and "On a remarkable relation between the difference of two Fagnanian arcs of an ellipse of eccentricity e, and that of two corresponding arcs of a hyperbola of eccentricity $\frac{1}{e}$;" and by Prof. Wolstenholme "On another system of Poristic Equations."

So far we have cited those memoirs only which treat of pure mathematics. There are, besides, papers by Mr. Röhrs, "On spherical and cylindric motion in viscous fluid;" by Mr. Routh, "On stability of a dynamical system with two independent motions," and "On small oscillations to any degree of approximation;" by Prof. Clifford, "On graphic representation of the harmonic components of a periodic motion;" by Prof. Crofton, "A method of treating the kinematical question of the most general displacement of a solid in space;" by Mr. Merrifield, "On the determination of the form of the dome of uniform stress."

Here is, as usual, sufficient variety for differing tastes dished up by the most advanced mathematicians in this country; other names also occur as contributories of communications, though their communications do not appear in this volume, notably those of Professors Sylvester, H. J. S. Smith, and J. Clerk-Maxwell. Further, a communication by Mr. A. J. Ellis, we are informed, took the shape of a separate pamphlet, entitled "Algebra identified with Geometry." This pamphlet arose out of Mr. Ellis's connection with the Association for the Improvement of Geometrical Teaching, and copies were kindly presented by him to the members of the two societies. It is procurable at the above-named publishers of the Mathematical Society's Proceedings.

Fiji: our New Province in the South Seas. By J. H. De Ricci, F.R.G.S. With two Maps. (London: Stanford, 1875.)

MR. DE RICCI'S book has the appearance of having been put together hastily, to catch the mild and short-lived excitement connected with the annexation of Fiji. A large proportion of it consists of extracts from other works thrown together without much attempt at systematic arrangement; the result is a somewhat undigested mass of facts and figures about Fiji. Still, the book does contain a great deal of useful and interesting information, and will give its readers a very fair idea of the history and the physical and social condition of our most recent annexation. The information given may be regarded as trustworthy, as it is taken from the works of Wilkes and Seemann, and from various official documents. Appended are lists of the native names of timber-trees and of the fauna; but very much more valuable is the long systematic list of all the Fijian plants at present known, compiled partly from previous writers and partly from the author's own observations. The two maps add to the value of the work—one of the Fiji Archipelago, and the other showing the position of the colony in reference to America, Asia, and Australia.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

Geology in America

I AM somewhat chagrined to find that I appear to you (vol. xi. p. 381) to say that the Geological Survey of Great Britain is especially to blame for the diminution of interest in geology in the country that has done the most for its advancement. My remarks were taken down by a reporter, and I have not seen them in print. The point I sought to make was to the effect that in all matters relating to geology, Massachusetts could not do better than to follow the lead of the British Survey. The only question to be considered was whether it was not open to criticism from an educational point of view. On this matter I expressed no individual opinion, but only restated doubts that I had heard expressed by more than one of your own masters in the science. I feel that geological science owes so much to your noble Survey, that none of its students should subject it to hasty criticism. If it is to have its methods questioned, it should be done by some one far better acquainted with its ways than any